THE NEED FOR INTEGRATING STRUCTURAL / SEISMIC UPGRADE OF EXISTING BUILDINGS WITH ENERGY EFFICIENCY IMPROVEMENTS – STATUS REPORT

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69TH ECCE GENERAL MEETING
30 MAY – 1 JUNE 2019,
PODGORICA, MONTENEGRO

INTRODUCTION

- On 10th of September 2018, I had submitted my revised proposal for the creation of an ECCE Position Paper titled "The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements", in order to be discussed and approved by ExBo.

- The ECCE Executive Board had a meeting on Monday 22nd of October 2018, during 68th ECCE General meeting, at the ICE Headquarters, London, United Kingdom. During the ExBo meeting I presented my revised proposal and we discussed the final proposal for the ECCE Position Paper "The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements".

- The position paper was also discussed during General Assembly and finally approved by ECCE on 23rd of October 2018.

WORKING TEAM

- <u>The Basic Coordination Team is:</u>

a) Eur. Ing. Platonas Stylianou – Cyprus (Coordinator of the working team), (P.S.)
b) Mr. Aris Chatzidakis – Greece, (A.C.)
c) Mr. Andreas Theodotou - Cyprus, (A.T.)
d) Dr Nicolas Kyriakides – Cyprus, (N.K.)
e) Mr. Daniel Bitca – Romania, (D.B.)
f) Mr. Andreas Brandner – Austria, (A.B.)
g) Dr. Branko Zadnik – Slovenia, (B.Z.)
h) Pr. Massimo Mariani – Italy, (M.M.)
i) Mr. Paul Coughlan – U.K. (P.C.)

- But contribution from all Countries members of ECCE is needed, since many countries have Experts and Professionals, that can help and contribute in the preparation and appraisal of the position paper.

SCOPE

- Our aim is to ensure sustainability, resilience and safety of existing buildings through structural or seismic upgrading against seismic and other dynamic actions and also enhanced energy efficiency.
- The solution provided should follow a holistic approach to address these issues simultaneously and link individual retrofit/upgrading activities in an integrated procedure. One of the most important issues, which defines the way of living, **is safe, sound, and secure buildings.**
- That is why there is a need to create a strong position paper, in order to convince E.U. member states and Brussels to grant funding for the Structural and / or Seismic Upgrade of the buildings, before, or at least together with, the grants given for the upgrade of the energy performance of buildings, under Directive 2010/31/EM, of the European Parliament and of the Council of 19th of May 2010.

MEETINGS WITH THE TEAM

- Further to the approval of the position paper by the General Assembly we had our first "standing" committee meeting on 23rd of October 2018, during the 68th ECCE General Meeting (five members of the working team participated, P.S., A.C., .T., A.B. and B.Z.).

- On 24th of October 2018, we had a meeting with Mr. Andreas Brander (A.B.) where we had set various milestones and deadlines:

a) Preparation of the draft questionnaire and send it to the team for comments.

b) Comments and finalization of the questionnaire by the team.

c) Send the Questionnaire to all the ECCE members.

d) Receiving of feedback, comments, and answer by the ECCE.

e) Skype meeting of the team after receiving feedback. Discussion and decision.

QUESTIONNAIRE

Ref: 151.GE.V05.2018

QUESTIONNAIRE

Title: "The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements"

Dear Colleague, please complete the following questionnaire and give us all details available.
Name and Surname:
Email:

A/A	QUESTIONS
I.	General
1	Does your Country suffer from earthquake or other dynamic loading problem or other combination of dynamic loadings and if yes approximately how frequently –Please attach historical records, if possible. ☐ Yes ☐ No If yes give details. .....
2	When was the last major / serious earthquake or other dynamic event that took place in your Country that affected the stability of buildings and civil works? What was the intensity? .....
3	Were the affected buildings or civil works repaired? Do you know what was the amount of money needed in order to repair the above? ☐ Yes ☐ No If yes give details. .....
4	Please briefly explain what damages does it causes (with regard to buildings, roads, bridges, etc.) .....
5	Where there any fatalities or serious injuries? ☐ Yes ☐ No If yes give data. .....

Ref: 151.GE.V05.2018

6	What was the time needed in order to fix the damages and to reinstate smoothly operation? .....
7	Are you aware of any special measures or others means applied, to mitigate/prepare for these events in your Country? ☐ Yes ☐ No If yes give details. .....
II.	State regulations/legislations and concrete experiences.
8	Is there a legal or technical guide/regulation on Energy Efficiency Upgrading of existing buildings in your Country? ☐ Yes ☐ No If yes give details (attach as well the Regulation or legislation). .....
9	Are there any legal or technical regulations/codes related to Seismic or Structural strengthening or upgrades in your Country? ☐Yes ☐ No If yes give details (please also attach the Regulation or legislation). .....
10	Are the Eurocodes applied for seismic assessments and seismic/structural strengthening of existing buildings in your country? ☐Yes ☐ No if yes give details .....
11	Are there incentives provided by the government, to individuals, for structural upgrades / renovations / seismic upgrades in your Country? ☐Yes ☐ No If yes give details. .....

Ref: 151.GE.V05.2018

12	Have you received any training related to seismic and energy efficiency upgrading? ☐Yes ☐ No If yes give details. .....
13	Have you participated in a workshop/conference on the above topics? ☐Yes ☐ No If yes give details. .....
III.	From practice
14	What are the most common building categories in your Country, regarding existing buildings build before 2000 and how many storeys are they? .....
15	What is the most widely used construction material for those buildings? .....
16	What is the common technique/material used for energy efficiency upgrading of existing buildings? .....
17	What are the most widely used techniques/applications for seismic strengthening of existing buildings? .....
18	Do you have unmaintained, deteriorated or abanconed buildings that suffer structural deficiencies/material degradation in your Country? ☐ Yes ☐ No If yes can you please give us numbers or percentage with regard to the total? .....

The questionnaire significantly contributed to the elaboration of the Position Paper, with the results given be as representative as possible including ECCE Member countries data.

The questionnaire is divided in three parts.

Part one, is the General part with 7 questions,

Part two, is the State Regulation/ legislation part with 6 questions, and

Part three, is the Practice experience and includes 5 questions.

FEEDBACK FROM COUNTRIES

After the dissemination of the questionnaire the feedback was:

- from Greece,
- from Malta,
- from Slovenia,
- from Bulgaria,
- from Germany,
- from Poland,
- from Russia,
- from Serbia,
- from Cyprus (2 questionnaires) and
- From U.K.

- On 27th of November 2018 we had a meeting with the European Commissioner Mr. Christos Stylianides regarding the topic of "intergrading structural upgrade with energy efficiency".

Participants:

Mr. Christos Stylianides (European Commissioner for Humanitarian Aid and Crisis Management),

Mr. Zacharias Giakoumis (Cabinet of Commissioner),

Mr. Aris Chatzidakis (President of ECCE),

Mr. Platonas Stylianou (EXBO member),

Mr. Andreas Theodotou (President of CYACE).

- Memo regarding all topics discussed was created and send to EXBO on 12th of December 2018.

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MEMO of the meeting with the European Commissioner Mr. Christos Stylianides on the topic of "intergrading structural upgrade with energy efficiency".

Participants:

Mr. Christos Stylianides (European Commissioner for Humanitarian Aid and Crisis Management),

Mr. Zacharias Giakoumis (Cabinet of Commissioner),

Mr. Aris Chatzidakis (President of ECCE),

Mr. Platonas Stylianou (EXBO member),

Mr. Andreas Theodotou (President of CYACE).

The European Commissioner for Humanitarian Aid and Crisis Management opened the meeting and welcomed the participants. He briefly explained his role and duties as an EU Commissioner and the new project named RescEU that he manages to achieve for prevention and preparedness (see attached documents).

The President of ECCE Mr. Aris Chatzidakis thanked the Commissioner for accepting us and made the necessary introduction explaining the ECCE organization, scope, members and history and make a short introduction to the problem of structural vulnerability and the necessity of structural and seismic upgrade in parallel with the necessary energy upgrades and to the scope of the meeting. Then he explained to the commissioner that we need to raise awareness for the safety of buildings.

Mr. Platonas Stylianou explained briefly the problem and that one of the most important issues, which defines the way of living, is Safe, Sound, and Secure building. He also explained the scope of the position paper and that the aim is to ensure sustainability, resilience, and safety of existing buildings through structural upgrading against seismic actions and enhanced energy efficiency. Then, he briefly explained the questionnaire prepared and the feedback that we are waiting from ECCE members. He also explained that when the position paper will be finalized, it will be disseminated in various ways (conferences, publications, media presentations, national professional boards, etc.) to raise the attention and ensure its continuation as a major European project in order to understand the need of structural and seismic upgrade in parallel with the necessary energy upgrades and to to attract EU funds for that purpose.

Mr. Andreas Theodotou analyzed the importance of structural upgrading of existing buildings against seismic actions for many European Countries and how it could be possible to be combined with the energy efficiency upgrading of the buildings. Finally, he pointed out that this target would be possible by European and National funding.

Finally, the Commissionaire explained to us that since elections are coming soon, it is not the time and

it's not easy for changes and a new era to occur. But he also explained to us that if we want to succeed then we need to continue with more pressure and more meetings with the country stakes of EU and the newly elected parliament members since it is a mere fact that we need and Europe needs Safe, Sound and Secure buildings and most probably a way will be found than EU grand to be given for that purpose. But the countries may need to contribute to that through their structural funds.

All participants agreed that lobbying is necessary in order for politicians and other people of influence, who are decision makers, to understand the necessity of "The need for Structural / Seismic Rehabilitation of Existing Buildings, in parallel with Energy Efficiency Improvements".

The conclusion of the day was made by the Commissioner saying that always "Prevention is better than Cure".

ADDITIONAL COMMENTS:

According to my personal opinion more need to be done in the future BUT the first step has been made. Lobbying needs to be continuously done and carried out toward that trend as well explained to the commissioner. Each country needs to do some lobbing through their national European parliament members and all stakeholders need to understand and support the idea.

The arranged meeting was well prepared and explained to the Commissioner who was frank, really friendly and supported the idea. I strongly suggest to continue discussions with Parliament members and the EU commissioners regarding all issues that need to be supported and funded by EU and are within ECCE and Civil Engineering scope.

The memo was prepared by Platonas Stylianou, ECCE ExBo member.

08.12.2018

- After the meeting with the Commissioner we had a Skype meeting of the working group on 04th of March 2019.

The following members participated:

a) Platonas Stylianou (PS),

b) Andreas Theodotou (AT),

c) Andreas Brandner (AB),

d) Branko Zadnik (BZ),

e) Nicholas Kyriakides (NK)

The meeting was coordinated by Mrs Maria Karanasiou (ECCE General Secretary).

Minutes

Meeting of the Working Group of the Position Paper "The need for integrating Structural / Seismic Upgrade of Existing Buildings, with Energy Efficiency Improvements"		
4-Mar-19	12:00 Athens time	Skype meeting
Meeting called by	Platonas Stylianou, ExBo member and Working Group leader	
Type of meeting	Working Group meeting	
Facilitator	Platonas Stylianou	
Note taker	Maria Karanasiou	
Attendees	Platonas Stylianou (PS), Andreas Theodotou (AT), Andreas Brandner (AB), Brank Zadnik (BZ), Nicholas Kyriakides (NK), Maria Karanasiou (MK)	
Apologies	Aris Chatzidakis, Massimo Mariani, Daniel Bitca	

Platonas Stylianou (PS) opens the meeting and welcomes everyone. He says that the material gathered from the questionnaire that was distributed among the ECCE members is more than expected. We have collected material from 10 countries which would be used as an appendix to the Position Paper. He asks the opinion of the members of the working group on how to use the materials that we have gathered and how to proceed from now on.

Nicholas Kyriakides (NK) introduces himself. NK is a lecturer in the Cyprus University of Technology at the department of Civil Engineering and Geomatics. He specializes on structural stability and assessment and retrofitting of existing buildings. At the moment he is working in a project in the University with similar subject as the Position Paper. He says that as far as the questionnaire is concerned it is obvious that we can gather a lot of information to strengthen our Position Paper and use them as an appendix. However, there is also some substantial information in the material we collected. It is pretty clear that there is lack of legislation in most of the countries concerning both upgrading solutions and this is something we need to highlight in the Position Paper because we need to emphasize the fact that any new initiative should start from proper legislation to back them. Secondly, he says that there is also evidence of lack of procedures or methods for this dual upgrading scheme because it is obvious that most countries have different procedures for each one of the problems and they are not treating them together. He adds that we should include some solutions that currently exist in the literature. He says that another thing that we should stress is the lack of unified data collection and analysis system related to damages and the current state of the building stock in the countries that have responded. So, this is the third thing that can be added and emphasize the Position Paper. He concludes that in the responses from the questionnaire maybe there is strong evidence not just to enrich but to strengthen substantially what we are trying to pass through our Position Paper.

Andreas Theodotou (AT) congratulates PS and AB for the preparation of the questionnaire. He says that we have gathered a lot of data and now we have to think about how to use all the data collected but he is not really sure what is the best way of doing it.

Branko Zadnik (BZ) says that the questionnaire and the responses we got are very interesting but he also isn't sure what we should do with them. He says that we must find a way to process this information and present it in a comprehensive way to the Brussels bureaucracy. He says that we need to have a clear message and to decide who is going to be the end user. He adds that we also need to find out how these initiatives work in Brussels.

PS says that he understands the worries expressed by the previous speakers. He says that we have a wide spectrum of answers to the questionnaire and various kinds of information collected. He says that the questionnaire was divided in three parts. The first part was a general one with seven questions, the second part consisting of six questions was a regulation/ legislation part and the third part consisting of five questions was the practical engineering part. He says that it is clear that each country has different legislation and engineering practices, other countries have earthquakes while others don't, some of them have different regulations, etc. He says that he understands the worries as we don't know exactly how we are going to use it but this is the scope of this team. He says that we

have to find the way how we are going to use it, if we are going to use all of it or some part of it. The material gathered is to support the Position Paper which purpose is to address politicians in Brussels trying to make them understand that sustainability, resilience and safety of existing structures can come only through structural upgrade and this should be enhanced with energy efficiency. He says that we must convince them that this very important and we should do both of the structural and energy upgrade to existing buildings and if we find a solution to have a holistic approach to this and address the issue simultaneously it is going to be a very wise procedure. He adds that we are now trying to emphasize the three "S"; Safe, Sound and Secure buildings. This is the message that we want to send to Brussels and to the whole Europe that safety is above all. We want to convince them that we want them to grant funding for the structural and seismic upgrade of buildings before or at least together with the grants given for the energy performance upgrade. He says that since they have a Directive for the Energy Efficiency of the buildings we should either tell them to amend this Directive if we can in order to include various structural issues in it or to create a new Directive including the structural upgrade together with the energy upgrade. He says that of course lobbying is very significant for this process in order to achieve our goals.

Andreas Brandner (AB) says that he attended a meeting in November on the Construction 2020 initiative. The discussion was to widen the scope on supporting renovation of buildings and all of the participants agreed that only the broad view including structural safety of the buildings together with the energy enhancement makes sense. He says that we are working on the view that we can't spend money on the energy upgrade of the building without first enhancing the building from the structural point of view otherwise it is wasted money. He says that we should support this idea with some numbers and bring those numbers together.

AT says that he agrees with what PS and AB have said. In his opinion all the data is really useful. He thinks that we should start by summarizing in one paragraph the data from each country.

NK says that he agrees with previous speakers. He says that the collected data should be dealt with and it must be exploited. He suggests adding specific information in the Position Paper and not just general aspects. He says he agrees with AT that we can add a summary of the countries' responses but this should be something very brief since we are going to attach the questionnaires as annexes. He thinks that if we look carefully the answers of the questionnaire and obtain a qualitative rather than a quantitative approach we have very good information to include in our Position Paper and to strengthen our argument considerably.

BZ says that the summarizing of the questionnaires must be put together and make a common statement out of this.

PS says that we have nothing against the energy efficiency upgrade. We all agree that this is important and necessary but together with it we need also the structural upgrade of the buildings, so we want both of them. What we want to stress is that the energy efficiency upgrade should be done after the structural upgrade of the building if it's needed.

BZ says that in Slovenia there is quite good legislation for earthquake engineering only for new buildings. They also have some kind of Building Act dealing especially with the energy improvement of old buildings. So, they would need a clear request to update the law on how to deal with old buildings.

PS says that if the rest of the team has useful information on the topic they can send it to everybody or put it in a Dropbox folder where all of the team can have access. He says that according to the timeline of the Position Paper we have accomplished the first stage of the creation, distribution and collection of the questionnaire. So, now we have to finalize the procedure and start with the creation of the Position Paper.

MK says that according to the ECCE Position Papers Guidelines the main body of the Position Paper can be 10-15 pages and the Executive Summary should be maximum 2 pages long.

PS suggests that ***the three Cypriot colleagues (PS, NK, AT) can start working on the Position Paper (abstract, table of contents, etc.) and then during the 69th ECCE GM in Montenegro we can have a meeting to discuss it and decide how to proceed.***

Further to the skype meeting we had a coordination meeting with Mr. Nicholas Kyriakides and Mr. Andreas Theodotou at my office (Cyprus) on 17th of May 2019, and
another one coordination meeting on 20th of May 2019 with Mr. Aris Chatzidakis, Mr. Andreas Theodotou and Mr. Nicholas Kyriakides were we discussed the progress of the position paper.

PRESENTATION AT FEANI SOUTH REGIONAL MEETING THAT TOOK PLACE ON 20TH OF MAY 2019

- During the framework of the above conference, I presented the work done for the creation of a Position Paper, which its target is to emphasize on the need to assess and structurally upgrade (if needed) existing buildings, when they will be Energy Upgraded.

- My presentation was disseminated by Mrs. Maria Karanasiou – ECCE General Secretary, to ECCE ExBo Members.

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FEANI SOUTH REGIONAL MEETING
20 May 2019, Nicosia, Cyprus

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POSITION PAPER – FINAL WORK

A. <u>CONTENTS</u>

1. Executive Summary
2. Introduction
3. Background/Existing knowledge: Sustainability and resilience of existing buildings
4. Scope, definition and objectives
5. Typical existing building categories/structural and energy performance
6. Codes and policies on energy and seismic upgrading of existing buildings and review of requirements for new buildings
7. Geographical characteristics of structural and energy efficiency of buildings
8. Retrofitting measures for seismic resistance upgrading
9. Recommendations and proposed solutions for integrated solutions for both seismic and energy efficiency upgrading

EXECUTIVE SUMMARY

- The majority of the existing building stock in most European countries built in the 80s, 70s or earlier lack of modern design standards including the requirements for seismic safety and energy efficiency.
- Thus, based on their date of construction, the vast majority are deficient both in terms of energy and seismic resistance. This creates the need for the society (public and engineers) to take actions to keep and maintain the building stock in operational, reliable and resilient state in order to ensure primarily the safety of the users.
- In civil engineering this ongoing process is achieved by updating the design codes to incorporate aspects studied after research laboratory work or identified through shortcomings in real hazard situations. In addition to safety, nowadays the comfort of the users is of prime importance. To satisfy the required comfort levels, the user should consume energy, in the form of heating, cooling etc. Therefore, this ongoing trend to satisfy these conditions, results in new buildings which are safer, more economic to operate and more sustainable (the three S approach).

- However, the current building stock of Europe comprises of structures that have been designed and constructed over a long period of years, spanning some decades although; for traditional masonry buildings this can be more than 100 years. A BPIE (Buildings Performance Institute Europe) survey [BPIE, 2011] revealed that a significant amount, over 40% of the existing building stock in EU is over 50 years old (only around 17% is constructed after 1991), i.e. exceeding firstly their design life and secondly are constructed during a period that Seismic knowledge and standards were very limited and energy performance guidelines were non-existent.

- It is easily understood that for this "aging" group of existing buildings, key challenges lie ahead, regarding their structural safety, sustainability and energy performance.
- The structural performance of buildings is related to their stiffness and strength as well as their ability to undergo non-linear (ductile) deformations. The extent to which a building can resist loads depends mainly on the characteristics of its lateral resisting structure (i.e. columns, beams and walls). Most existing buildings do not pose significant lateral resistance and require upgrading to increase the efficiency of one or more of the above. For EU countries in the south-eastern Europe, the structural performance and safety is intertwined with seismic vulnerability.
- In the case of the aging existing buildings, the lack of consideration for the seismic effect means this building stock is more vulnerable to earthquakes. In addition, as it is exceeding its design life of 50 years, it means that along with strengthening interventions to improve the seismic performance, durability and structural assessments should also be carried-out to ensure functionality and thus safety and comfort for the users.

- In addition to safety, in the last decade the importance on the energy front has been highlighted; increased energy consumption lead to adverse environmental impact (e.g. climate change). Therefore, for the building sector the energy efficiency term is introduced, which is highlighted by the Europe's aim to reduce by 2020 the Greenhouse emissions by 20% and achieve 20% energy savings [EPBD recast, 2010/31/EU]. The building sector accounts for large energy consumption in EU with the European households using nearly the 70% of the consumed energy in the form of electrical energy. A survey by BPIE (2011) on energy consumption revealed that the older building stock is the main contributor to this. This is expected as in the EU the main policy regarding the energy use in buildings is the Energy Performance of Buildings Directive (EPBD, 2002/91/EC) initially issued in 2002, and re issued in 2010.

- Therefore, it is evident that there is a big portion of the existing EU building block that is under-designed, regarding their seismic capacity and also their energy performance is well below the national minimum requirements set in the last fifteen years and therefore in need of structural and energy renovation to remain operational and safe.
- To improve the seismic performance/capacity of existing buildings that have not been designed according to the earthquake standards of Eurocode EC8 (CEN2005), a variety of techniques based on the typology of the building and the level of the required strengthening are currently used.
- For RC structures, the seismic retrofit techniques are generally divided to local and global methods [JRC 2014a]: Local methods are concentrated in improving the performance of particular structural members and they most commonly include the strengthening of the column-to-beam joints, column and beam jacketing and column and beam strengthening with advance materials such as fibre reinforced polymers (FRP) or combined with new technology such as the textile reinforced mortar (TRM) technique in addition to traditional RC jacketing. Global methods may be provided with the addition of shear walls and foundations strengthening, which will lead to the change of the type of the structural system.

- Regarding the energy performance level of buildings, it is influenced by a number of factors including the installed heating/cooling systems, the climatic conditions and the building envelope. The energy demand of buildings can be reduced by improving the insulation of the envelope, increasing the thermal capacity of the building and by using energy efficient systems in the building's operating processes e.g. heating [JRC 2012]. Therefore, any potential energy saving measures are inter-related with these factors with greatest focus on aging existing buildings which have the largest energy consumption due to insufficient insulation of the building.
- The insulation of the envelope can be improved by reducing the energy loss from windows and doors and by insulating the walls and the roof [IEA 2013]. For the latter, the level of improvement depends on the thickness of the provided insulation and the properties of the insulating material, although thick insulating layers are unfavorable due to limitations in space, aesthetics reasons and other technical constraints [JRC 2014a].

- Currently, from a sustainability perspective, emphasis is placed on developing an integrated structural and energy design methodology for new buildings that should be preferred over individual actions to ensure a Sustainable Structural Design (SSD). Such approaches like the SSD methodology will ensure that new buildings satisfy both structural safety and energy efficiency targets.
- However, for existing buildings, especially of a certain construction age, the problem of seismic and energy inefficiency is of primary importance and a similar in concept approach is required to provide upgrading on both fronts. Only the last few years it is acknowledged that such independent retrofit actions should be integrated to enhance the overall performance. It started with an effort to relate seismic efficiency with environmental benefits resulting from the mitigation of damage and/or demolition because of earthquakes. This is followed by a multidisciplinary approach to improve building's performance taking seismic and energy efficiency on equal consideration.

- **Finally**, this position paper aims to review and examine the parameters involved in an integrated holistic approach to enhance the overall performance of existing buildings and provide solutions to close the gap, regarding the beneficial simultaneous refurbishment of the structural / seismic capacity and energy efficiency of existing buildings.

THANK YOU